REMARKS

The present invention is directed to the extrusion apparatus employed in Applicants' continuous process for forming noise attenuating flexible cutting line for use in rotary vegetation trimmers. That line is now the subject of Applicants' U.S. Patent No. 6,910,277. The high pitch whine generated by conventional nylon cutting line in these high rpm trimmers travels quite far and is objectionable to many people who are not even in the immediate proximity of the rotating trimmer head. As a result, there has developed a growing need for noise attenuating cutting line. For such line to be commercially viable, however, it must be economical to produce, the extrusion apparatus of the present invention allows for the economical production of Applicants' newly patented noise attenuated trimmer line.

The line which is produced by the apparatus of the present invention provides superior noise attenuation in its preferred embodiments through a novel twisted configuration in which two or more generally V-shaped troughs are formed that extend helically along and about the longitudinal axis of the line. To create such a line configuration, the Applicant extrudes two cylindrical strands of monofilament and twists the strands about each other while in a molten condition such that the strands bond together in fused seams that extend along the bottoms of the V-shaped troughs. This is achieved by a novel forming process wherein the molten monofilament is extruded through a die that defines a pair of preferably circular die holes. As the molten monofilament is extruded through the die, the die

is rotated about its central axis at speeds from about 750 to 2500 rpm to effect the desired tight twist in the line.

To provide the necessary flexibility and durability in the resultant cutting line, it is necessary that the formed line, following extrusion and cooling, undergoes a reheating and stretching step during which the line is stretched approximately three times its original length. This is true of all extruded monofilament cutting line, regardless of its shape. As a result, however, the number of twists per linear foot in this new line is reduced by a factor of about three. However, Applicant has found that, at least within certain ranges, increasing the number of twists in the line per foot, increases the noise attenuation. Applicants' new apparatus for extruding and twisting together two separate molten strands of monofilament allows for a tighter twist in the final product, and thus a quieter line than could be produced by twisting a single strand about its own axis. This process also allows the line to be formed in a continuous on-line process, as is the case with conventional nylon cutting line, thereby avoiding the need for separate and costly secondary processing (*i.e.*, carving or twisting the line after it is extruded). The elimination of the need for such secondary processing significantly reduces the cost of manufacture.

By the present Amendment, Applicant has updated the current status of the parent application as required by the Examiner to claim the priority benefit of that application. In addition, Applicant has amended the claims to more

particularly recite the monofilament material with which the assembly of the present invention is used to form the cutting line. Applicant has also corrected the numerical error at page 16, line 18 so as to properly refer to the breaker plate by the reference numeral 34. Such a correction also obviates the objection to the drawings which previously identified the breaker plate by reference numeral 34.

In addition to the above, Claims 2, 10-14, 21, 27 and 29 were objected to as being of improper form for failing to further limit the subject matter of the previous claim. Applicant has amended these claims as well as dependent Claim 25 to place these claims in proper dependent form, obviating this rejection under 37 C.F.R. 1.75(c). In so doing, the double patenting objection to Claims 36 and 37 are also obviated as Claim 29 now is limiting. Finally, Claims 1, 2, 10-15, 20, 21, 25 and 27-29 have been amended to eliminate the objectionable word "predetermined" to eliminate what the Examiner perceived as an ambiguity in those claims. While it was not believed that the term rendered those claims ambiguous, as one skilled in the art would clearly understand the meaning of "predetermined speed" from the specification, it is not believed that the removal of the objected to term adversely impacts the scope of the claims. With the above noted amendments, the sole remaining issues are the obviousness of the claims under 35 U.S.C. § 103(a) in view of the cited art.

All of the claims in the pending application (nos. 1-37) stand rejected under 35 U.S.C. § 103(a). Specially, Claims 28-37 were rejected under 103 as being

patentable over Proulx (5,807,462 – the Proulx '462 patent) in view of Groff et al. (4,288,463 – the Groff '463 patent) or any one of six other patents each further in view of Mize et al. (4,186,239). Claims 1-27 which contain a more detailed description of the apparatus of the present invention than Claims 28-37 were rejected under the same art as Claims 28-37 in addition to six other patents which assertedly taught various elements of the assembly. For the reasons to be set forth, these rejections are traversed. The Proulx '462 patent which forms the basis for all of these rejections teaches a process for forming flexible cutting line. However, that process forms a line having a very different configuration and one that is not at all related to noise attenuation. Just as the products are quite different in their configuration and purpose, the processes and apparatuses for forming them are also different.

Proulx '462 discloses a process and apparatus for forming cutting line that solves the problem of line tangle within the trimmer head housing. Because the head of a trimmer typically employs at least two separate cutting lines, care must be taken in winding the lines about the common spool to prevent the lines from crossing over one another or otherwise tangling within the housing. This problem was particularly acute in automatic and bump-feed type heads in which fresh line is paid out the housing during use by centrifugal force without having to stop the trimmer, open the housing and manually pull fresh line from the interior spool. Proulx '462 sought to make a line comprised of two strands of monofilament

joined together in a side by side relationship along a thin, readily severable bond. The severable bond or weld held the two strands together in a parallel disposition within the housing so that they would not cross over one another and tangle. Yet, the two bonded strands could be readily separated proximate their extended ends so that they could individually project through opposition guides in the side of the housing. To accomplish this task, the weld that joins together the two parallel lines must be quite delicate for use on automatic and bump-feed heads or the end portions of the strands will not separate within the housing and the trimmer head will jam. Thus, Proulx '462 teaches one how to extrude two parallel strands of monofilament joined together by a readily severable weld.

The present invention, unlike that disclosed in Applicants' Proulx '462 patent, seeks to form a cutting line in such a way as to attenuate noise. As a result, the severability quality, which was of key importance in Proulx '462, is of no utility here and, indeed, must be avoided. In contrast to a double-strand filament line with a severable weld, the strands of the present invention are permanently welded together and twisted about each other to form a single length of line. Accordingly, there is nothing in Proulx '462 that teaches or even suggest that cutting line can be configured so as to be noise attenuating by twisting two strands of molten monofilament together as claimed. There is nothing in Proulx '462 that teaches that strands of extruding molten monofilament can be twisted together to form a single length of monofilament; that such molten material can be twisted during

extrusion to provide any particular cross-sectional configuration; or that any particular or cross-section of trimmer line would be useful in attenuating noise. In fact, Proulx '462 teaches away from the present invention and twisting together of molten strands because the invention comprises a single length of line formed by fused strands. Fusion of the strands is exactly what the Proulx '462 process was trying to avoid. Further, any twisting of the line formed by the Proulx '462 process would break the severable weld which the process is designed to create. Thus, Proulx '462 would be of little assistance to one skilled in the art attempting to develop the claimed assembly.

The Groff Patent No. 4,288,463 and all of the other cited patents upon which Claims 28-37 stand rejected, except the Mize et al. patent, are not directed to flexible vegetation cutting line or its manufacture. These patents each teach a method and apparatus for forming various food items by extruding a highly viscous food product such as pretzel dough through a rotating die to twist the dough being extruded therethrough. Before discussing these patents individually, we respectfully submit that one skilled in the art of making flexible vegetation cutting line from molten monofilament would not look to a patent on a pretzel forming or similar dough twisting process in order to make noise attenuating cutting line for rotary vegetation trimmers. The art is not analogous. The extrusion of highly viscous food stuffs has nothing to do with noise attenuation, nor is it relevant to

extruding the molten monofilament employed in the manufacture of the lines used in rotary trimmers to cut vegetation.

Briefly, the Groff '463 patent discloses a mechanism employing rotating extrusion dies wherein pretzel dough is extruded into a spirally-configured pretzel for subsequent baking. Pretzel dough is very different from molten monofilament and the two materials behave extremely differently upon extrusion. Pretzel dough is extremely viscous and will tend to hold its shape when it makes contact with a surface. The molten monofilament, typically nylon, employed in the manufacture of trimmer line and used in Applicants' invention is quite fluid and tends to flow. Pretzel dough stays at a relatively constant temperature until it is baked after extrusion. As noted in the application, the molten monofilament is in a liquid state as it passes through the die apertures and has a specific setup point at which it begins to rapidly crystallize inwardly from its outer surface. As the strands of molten monofilament are extruded and twisted into the desired shape during the process of the present application, the material passes through multiple temperature zones, including a cooling quench bath and heating oven. During this process, the molten strands first crystallize on their outer surface as it is the outer surface that first cools. The interior of the strands are initially still in a liquid state when crystallization begins. The strands then quickly crystallize inwardly from their outer surfaces as cooling continues. However, when the strands are first twisted together by the rotating dies above the cooling quench bath, they are both in

a molten or liquid state. There is nothing in Groff that suggests how to handle such a material or that such a material could be extruded through two adjacent openings and twisted together as claimed in the present application. There is simply no similarity whatsoever in the handling and extrusion of the two materials to form a twisted configuration. We respectfully submit that one would not look to a patent dealing with pretzel dough to teach one skilled in the art of trimmer line manufacture how to handle and extrude a molten nylon copolymer material into a particular configuration. Indeed, as will be shown, the remaining cited patents dealing with rotating extrusion dies, all deal with dough or food stuffs of similar viscosity and virtually all of those patents make a specific reference to the viscous nature of the extrudate.

In addition to the Groff '463 patent, the Examiner also cites Groff Patent No. 4,445,838. This patent is a purported improvement over the Groff '463 patent and specifically states that the invention disclosed therein is concerned with the extrusion of viscous comestible material, such as pretzel dough, corn meal, or the like and is intended for use with any such material of dough-like viscosity. The material of which trimmer line is formed certainly does not have dough-like viscosity in a molten state (see col. 1, lines 5-10).

The next patent cited by the Examiner is Soderlund et al. (3,876,743) which discloses a process and apparatus for making novel food products by extruding a plurality of separate plastic strands of food material through a

stationary die to produce a composite stick-like product. In Soderlund, unlike Applicants' product, the extrusion die is held in a fixed position, does not require moving parts and the axial extrusion bores are angled toward a common axis and are skewed or offset about the axis in the same direction to create the desired helix configuration. Thus, not only does this patent again deal with a viscous food product, it does not employ moving parts as specifically required by Applicants' apparatus.

The cited Cockings et al. Patent No. 5,492,706 again deals with food stuffs and, more particularly, the extrusion of a continuous strand of a dough or biscuit mix type material and an enveloping sheath of a second material such as meat or sauce that is twisted about the first material. Again, one would not look to such art in attempting to extrude a molten nylon material into a particular configuration for use in trimmer line.

The cited Heck et al. Patent No. 5,670,185 is similar to Groff in that it teaches a die assembly for extruding edible substances having a high viscosity (see col. 1, lines 60 – col. 2, line 2). The cited Israel et al. Patent No. 5,609,903 also teaches a device for extruding doughs and other viscous materials to form an aesthetic interwoven multi-strand food product. Finally, Bortone (6,607,772) teaches a process and apparatus for the production of a braid-shaped puffed extrudate such as that marketed under the Cheetos™ brand label. In Bortone, it is again viscous food stuffs that are being extruded. However, a helical air flow is

employed to create a turbine effect that twists the extrudate into a braided configuration.

None of the aforementioned cited patents, other than Proulx '462, have anything whatsoever to do with monofilament trimming line, noise attenuation or the extrusion of monofilament or of any other molten or liquid-like material. In contrast, these patents deal with the simple extrusion of highly viscous food stuffs like bread dough or pasta which, as noted above, holds their shape and set up slowly. As a result, such shapes are routinely extruded onto a conveyor that transports the extruded dough to the oven. These materials clearly behave entirely differently than molten monofilaments. Accordingly, it is respectfully submitted that one skilled in the art of trimmer line design and manufacture would not look to food preparation apparatus and processes in attempting to design and manufacture a noise attenuating trimmer line from a molten monofilament.

The Mize et al. patent is cited for its teaching of a twisting multi-lobe cutting filaments and teaches an oblately shaped filament for the purpose of reducing fibrillation. The Examiner further notes that Mize substantially teaches rotating a filament of any desired shape about a central longitudinal axis. It is respectfully submitted that the Examiner's statements misinterpret the teachings of Mize. First, it is important to note that the Mize patent is concerned only with fiber fibrillation (fraying) and fiber fibrillation is not at all related to noise attenuation. The fibrillation relates to the durability of the product not its noise

generating characteristics. The undesirable effects of fibrillation are illustrated in Figure 6 of the Mize patent. Second, the only twisting of cutting line in Mize is accomplished as a secondary process after the line has been formed (extruded) and indented to inhibit fibrillation. The only twisted line shown in the Mize patent is in Figure 11. The Mize patent does not describe how that line is formed. However, from the regular spacing of the indentations along the top of each lobe, it is quite clear that it could not have been formed into a twisted configuration before the indentations were formed in the line. If a twisted line having four lobes were subject to an indenting process, such as that illustrated in Figure 5 of the Mize et al. patent, the indentations would be randomly formed on the line as the forming or cutting wheels are aligned 90° with respect to each other and the lobes are twisted, not aligned along the tops of the lobes as shown in the patent. The indentation configuration shown in the Mize et al. patent could not be formed in a continuous automated extrusion process. Certainly Mize does not disclose such a process. He does, however, show in Figure 9 the same line in an untwisted state. Quite clearly, Mize suggests that the twisted line of Figure 11 could be formed from a non-twisted four lobe configuration as shown in Figure 9, indented as shown to prevent fibrillation, then heated and twisted to provide the configuration of Figure 11. Thus, it is respectfully submitted that Mize does not teach one skilled in the art how to extrude a twisted line formed of two adjacent or overlapping strands. In

fact, he does not teach how to extrude a twisted strand of any configuration. The only twisted configuration is clearly a product of secondary processing.

In summary, the prior art cited by the Examiner has absolutely nothing do no with noise attenuating cutting line. The only patent that is related to cutting line, the Proulx '462 patent, teaches a process of concurrently extruding two strands of molten monofilament in an adjacent parallel disposition so as to form a readily severable weld therebetween for use on automatic and bump-feed trimmer heads. The present invention, unlike that disclosed in the Proulx '462 patent, seeks to form a cutting line in such a way as to permanently join the two strands in a desired shape to attenuate noise. As a result, the severable quality of the Proulx '462 line, which was of key importance in the '462 patent, needs to be avoided in the formation of the present line. As noted earlier, the Proulx '462 patent teaches away from the twisting together of molten strands because doing so would necessarily fuse the strands together which is exactly what the process of the Proulx '462 patent avoids.

While Mize et al. discloses a twisted line, he does not disclose how to form such a line, which is the purpose of the apparatus of the present invention, nor is he at all concerned with noise attenuation. The present invention is unrelated to any concern regarding fibrillation. Mize also does not teach that monofilament can be twisted during extrusion or that twisted monofilament line can be formed in a continuous process. For the reasons noted above, the drawings in the Mize et al.

patent strongly indicate that the twisting of the line in Figure 11 is accomplished through a secondary process, not through any extrusion process. The aligned configuration of the indentations 40 in that line are strongly indicative of that fact and there is absolutely nothing in Mize to the contrary. To assume that the line in Figure 11 was twisted during extrusion is an improper reading and application of the reference.

Finally, the mechanisms which were cited to demonstrate that an extrusion process can form a configuration having the desired cross section of Applicants' trimmer line are all concerned with the extrusion of highly viscous food products not a molten glass-like material. Absent any teachings that molten monofilament can be twisted during extrusion; that molten monofilaments can be twisted during an extrusion process to form a single length of a desired cross-sectional-shape; that forming a trimmer line with the opposed trough configuration taught by Applicants would provide noise attenuation; and that such material can be extruded in a manner so as to provide such configuration, it is respectfully submitted that the subject matter of Claims 28-37 is not obvious as asserted by the Examiner. There is simply no suggestion in any of the art that one can twist a molten nylon material to form a desired shape or that the shape has utility. For all of these reasons, it is respectfully submitted that the combination of multiple references cited by the Examiner would not be obvious to one skilled in this art.

Claims 1-27 differ from Claims 28-37 in that they more definitively recite the elements of the claimed apparatus. All of the arguments set forth above with respect to Claims 28-37 are equally applicable to Claims 1-27. For example, each of Claims 1-27 recite as an element thereof a breaker plate defining an inclined inner portion and a substantially planar outer portion, said inner portion directing molten material from the channel in the housing on to the outer portion of the breaker plate. The Office Action states that the cited Mott patent teaches such a configuration and identifies numerals 15 and 17 as representing the inclined inner portion and a planar outer portion. However, it is respectfully submitted that a review of the Mott reference shows a very different configuration than that employed and claimed by Applicant. The reference numerals 15 and 17 in the Mott patent identify an extended area filter (15) and porous filter tubes (17). These elements do not define the inclined inner portion 48 and planar outer portion 50 claimed by Applicants and clearly illustrated in Figure 7 of the application.

The cited Cooksey et al. patent also fails to teach the claimed breaker plate. In lieu of the inclined inner portion which is conically shaped in the embodiment of the breaker plate illustrated in Figure 7 of the application, Cooksey et al. employs a plurality of inclined delivery channels each of which terminates in an opening at its lower end for delivery on to a distribution space 31 which is predominantly disposed inwardly of the channels 27. In contrast, Applicants claimed inner surface delivers the molten copolymer material on to the outer planar

surface such that it can pass through openings therein on to the rotating dies which communicate with and are positioned about the annular outer surface. Such a configuration involves a far more effective distribution of the polymer material into the individual rotating dies than would result from filling an entire area below the breaker plate analogous to area 31 in the cited Cooksey reference. Again, the cited reference does not teach or suggest the particular breaker plate configuration recited in the claims. It is respectfully submitted that the remaining patents cited by the Examiner also fail to teach the claimed structure. It is believed that if those patents are carefully reviewed, the differences in the structures from the claimed surfaces will become readily apparent.

In conclusion, it is respectfully requested that the Examiner reconsider his rejection of the claims pending in the present application. Given the disparate difference in the technologies with which Applicants' device and the apparatus of the prior art are used, the differences in materials and the extrusion characteristics of those materials and the total failure of the art to teach or suggest that Applicants' noise attenuating cutting line could be formed by a continuous extrusion process, it is respectfully submitted that the apparatus recited in the claims of this application is not made obvious by the cited art. It is therefore

respectfully requested that the pending claims be allowed and the application passed to issue.

Respectfully submitted,

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